

CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

CLARK DIKE

REPAIR AND COMPLETION

STATION 3 + 00 to STATION 117 + 00

CONNECTICUT RIVER

HARTFORD, CONNECTICUT.

DECEMBER 15, 1938.

CORPS OF ENGINEERS, U. S. ARMY

U. S. ENGINEER OFFICE

PROVIDENCE, R. I.

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December 15, 1938.

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
PROVIDENCE, R. I.

APPROPRIATION: Emergency Relief, 1938.

REPAIR AND COMPLETION OF CLARK DIKE ALONG CONNECTICUT RIVER
HARTFORD, CONNECTICUT.

S P E C I F I C A T I O N S

SECTION I. GENERAL PROVISIONS

1-01. Location. - The site of the work covered by these specifications is located on the west bank of the Connecticut River, in the south portion of the City of Hartford, Connecticut, known as the Clark Dike, South Meadows.

1-02. Work to be done. - a. The work provided for herein is authorized by the Emergency Relief Appropriation Act of 1938.

b. The work to be done consists of furnishing all plant, labor and materials, and performing all work required to reconstruct the existing Clark Dike to its original section, complete in accordance with these specifications and drawings forming a part hereof, and to make such other repairs as directed by the District Engineer.

c. The following principal items of construction and repair are involved.

(1) Completion of the existing dike between traverse stations 3+00 and 117+00.

(2) Repairing portions of the existing dike as follows:

(a) Filling and dressing eroded gullies (see Paragraph 5-04).

(b) Replacing impervious blanket (see Paragraphs 3-06 and 4-06).

(c) Re-dressing of embankment slopes (see Paragraph 8-01).

(d) Extension of the drainage system (see Section VI).

1-03. Organization. - The work described in these specifications will be executed by the Area Engineer whose responsibility shall correspond to that of "contractor" as defined in Article 1, standard construc-

tion contract form No. 23. The District Engineer as the officer responsible for the final accomplishment of the work specified will correspond to the "contracting officer."

1-04. Responsibility of the District Engineer. - a. The District Engineer will design the work, prepare the plans, and decide all questions which may arise as to performance, quantity and quality, acceptability, fitness and materials to be furnished and used, and the rate of progress of the work as described by these specifications and will decide all questions which may arise as to interpretations of the specifications and drawings.

b. Changes which are necessary due to changed conditions in the field and necessitate a change in the specifications or drawings will be made in writing by the District Engineer provided that any change involving an estimated increase or decrease of more than \$500 will be subject to the final approval of the Division Engineer.

c. The work will be conducted under the general direction of the District Engineer and will be inspected by inspectors appointed by him. The organization of the inspection staff will be entirely separate from the Area Engineer's organization and will be directly responsible to the District Engineer. It is understood that any instructions given by the District Engineer through an inspector or other authorized employee are to be considered instructions or decisions of the District Engineer in all cases.

1-05. Description of project. - The section of earth dike covered by these specifications is of the rolled-fill type, top elevation 43.0 m.s.l. at the upstream end to elevation 42.5 m.s.l. at the downstream end, with an average height of 35 feet above the existing ground surface. The completed dike will be 4.25 feet above the grade recommended by the Board of Engineers for Rivers and Harbors. (See Paragraph 1-11).

1-06. Drawings. - a. The work shall conform to drawings marked "Clark Dike, repair and completion from Station 3 + 00 to 117 + 00", comprising 8 drawings numbered and titled as follows:

<u>Sheet No.</u>	<u>Title</u>	<u>File No.</u>
1	Project Location and Index	CT-4-1147
2	Borrow Areas	CT-2-1118
3	General Plan	CT-4-1145
4	Typical Sections	CT-4-1146
5	Typical Sections and Details	CT-4-1240
6	Details of Ramp at Station 7 + 00	CT-4-1241
7	Details of Ramps at Station 43 + 00	CT-4-1242
8	Toe Drainage Details	CT-4-1310

all of which form a part of the specifications, and which are filed in the United States Engineer Office at Providence, Rhode Island.

b. The work shall also conform to such other drawings relating thereto used in explanation of details or minor modifications as may be furnished by the District Engineer from time to time during construction.

1-07. Quantities. - The following estimate of net quantities is given to serve as an indication of the extent of the work covered by these specifications:

<u>Item No.</u>	<u>Designation</u>	<u>Unit</u>	<u>Quantity</u>
1	Preparation of site	acres	open
2	Stripping	cu.yds.	400
3	Common excavation, general	" "	1,000
4	Common excavation, borrow areas	" "	70,000
5	Common excavation, toe-drain trench	" "	3,500
6	Common excavation, impervious blanket	" "	52,000
7	Impervious fill, placing and rolling	" "	70,000
8	Pervious fill, placing and rolling	" "	15,000
9	Gravel bedding	" "	3,200
10	Semi-compacted backfill	" "	1,000
11	Random fill	" "	5,000
12	Tile drains (12" V.C.)	lin.ft.	7,200
13	Grouted stone gutters	sq.yds.	1,400
14	Corrugated pipe (12" dia.)	lin.ft.	150
15	Catch basin gratings	lbs.	750
16	Concrete	cu.yds.	2
17	Topsoil on embankment	" "	36,000
18	Sodding and seeding	acres	28
19	Gravel for top of dike	cu.yds.	3,300
20	Cleaning up		open

1-08. Physical data. - a. General. - Materials for constructing the earth dike are available in the vicinity of the work. Locations of borrow areas are shown on the drawings. Borings and test pits have been made in the vicinity of the proposed work with reasonable care and substantially at the places indicated on the drawings. Laboratory analyses have been made of the samples from many bore holes and test pits. Samples of materials taken from them, and records of laboratory analyses and other studies may be seen at the United States Engineer Office, Providence, Rhode Island.

b. Transportation facilities. - (1) Railroads. - The New York, New Haven and Hartford Railroad serves the City of Hartford with main line traffic, and adequate siding facilities are available in close proximity to the work. The Area Engineer shall investigate the availability of sidings, and make all arrangements with the railroad for any sidings necessary for delivery of materials and equipment to be used on the work, when necessary.

(2) Waterways. - A 15-foot channel with 94-foot minimum overhead clearance is maintained in the Connecticut River up to the highway bridge at Hartford, which is a short distance upstream from the site of the (Clark) South Meadows Dike. Above the bridge there is limited

draft and overhead clearance. For navigation data see U.S.C. & G.S. Charts Nos. 215, 254, 255 and 256. The normal river stage is 3.5 feet m.s.l. at the Hartford bridge, and usually varies from a low stage of 1.5 feet m.s.l. in August to a high stage of 20+ feet m.s.l. in April. Freshets producing higher stages may occur at any month of the year as a result of heavy rainfall.

(3) Highways. - First-class highways also serve the city and there is reasonable access to all parts of the project. The Area Engineer shall construct and maintain all construction roads required, and investigate available roads for transportation, including load limits for bridges and roads, and any other road conditions affecting transportation of materials and equipment to the site.

c. Weather conditions. - The locality is subject to atmospheric temperatures ranging from minus 18 degrees to plus 101 degrees Fahrenheit. The mean annual precipitation at Hartford is 42.50 inches. The mean monthly precipitation varies from a low of 3.22 inches in June to a high of 4.20 inches in August.

1-09. Lands, rights of way, damages. - a. The District Engineer will designate the lands, rights of way and easements which will be required for the project, and the Area Engineer shall undertake the construction only when approved assurances shall have been obtained from local interests and when local cooperation has been assured as required by Section 3 of the Flood Control Act (Public No. 738 - 74th Congress).

b. In the pursuance of the work covered by these specifications, no money appropriated for the construction of the project will be expended until the City of Hartford has given assurances satisfactory to the Secretary of War that it will:

(1) Provide without cost to the Government all lands, easements, and rights of way necessary for the construction of the project as defined by these specifications.

(2) Hold and save the Government free from damages owing to the construction work.

(3) Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of War.

1-10. Removal of rubbish. - The Area Engineer shall keep the site free from rubbish. Suitable spoil areas for receiving refuse from the grounds shall be provided, and the rubbish shall be removed and disposed of as directed by the District Engineer and in a manner agreeable to the local interests and in accordance with the sanitary provisions of Paragraph 1-18. At the conclusion of the work, the site shall be cleaned up and all rubbish and unused materials shall be disposed of in accordance with Paragraph 8-03 of these specifications.

1-11. Datum and bench marks. - The plane of reference of Mean Sea Level as used in these specifications is that determined by the following bench mark:

Description of Bench Mark
FB at Hartford

Hartford County on the New York, New Haven and Hartford Railroad, 60 feet west of the station, in Bushnell Park, 15 feet south of the south rail, 10 feet west of Asylum Street, 6 feet south of a high stone retaining wall, and 30 feet lower than the track. A standard U.S.C. & G.S. disk, stamped "F 8 36.98" and set in the top of a concrete post. Elevation 11.222 meters or 36.813 feet.

1-12. Lines, grades, stakes and templates. - The Government inspector will define and approve on request all points and elevations reasonably necessary for the prosecution of the work from lines and grades established by the survey parts.

1-13. Planimeter. - For the estimating of quantities the planimeter shall be considered an instrument of precision adapted to the measurement of plotted areas unless otherwise directed by the District Engineer.

1-14. Responsibility for work. - The Area Engineer shall take all responsibility for the work and take all precautions for preventing injury to persons and property in or about the work.

1-15. Borrow areas. - Borrow pit areas will be furnished by the local interests without cost to the Government, including rights of way for transportation purposes across property not owned. If sufficient material is not available in the borrow areas indicated on the drawings or otherwise provided to complete the work, additional areas will be furnished without cost to the Government.

1-16. Soil classifications. - a. Soil classifications as referred to in these specifications conform to descriptive terms and limits of classifications as shown on Table No. 1 "Soil Classification" and Plate No. 1 "Diagram Showing Limits of Soil Classes," both of which form a part of these specifications.

b. Table No. 1 - Soil Classification.
(See page 6 for Table No. 1)

c. Plate No. 1 - Diagram Showing Limits of Soil Classes.
(See page 7 for Plate No. 1)

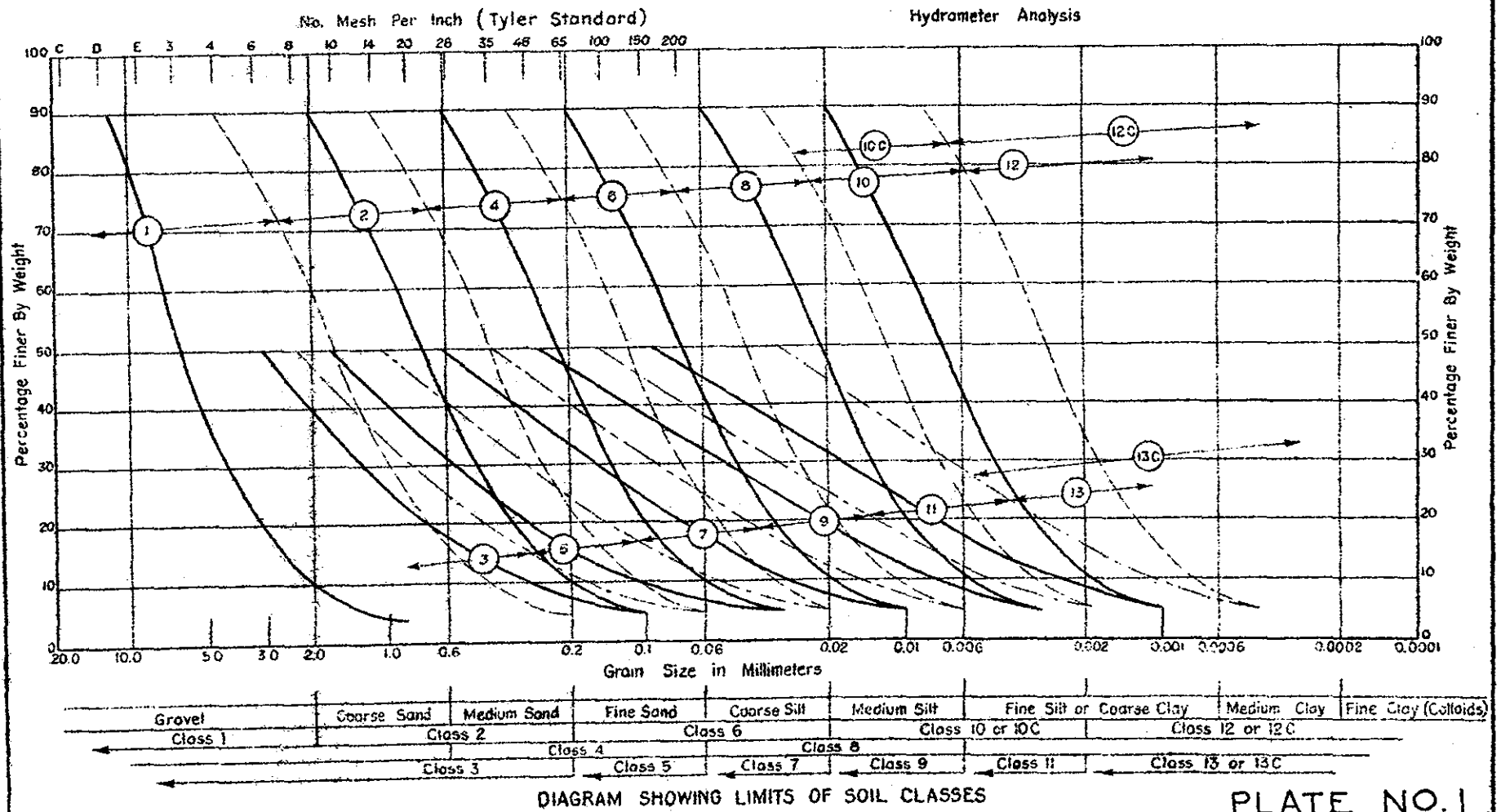
1-17. Material purchased by the District Engineer. - All orders, shipping bills or memoranda accompanying material purchased by the District Engineer shall clearly indicate weights and shall be so worded or marked that each item, piece or member can be definitely identified on the drawings.

PROVIDENCE SOIL CLASSIFICATION
U. S. ENGINEER OFFICE
PROVIDENCE, R. I.

TABLE NO. I

CLASS	DESCRIPTION OF MATERIAL
1	: <u>Clean Gravel.</u> - Contains little coarse to medium sand.
2	: <u>Uniform Coarse to Medium Sand.</u> - Contains little gravel and : fine sand.
3	: <u>Variable - Graded from Gravel to Medium Sand.</u> - Contains : little fine sand.
4	: <u>Uniform Medium to Fine Sand.</u> - Contains little coarse sand and : coarse silt.
5	: <u>Variable - Graded from Gravel to Fine Sand.</u> - Contains : little coarse silt.
6	: <u>Uniform Fine Sand to Coarse Silt.</u> - Contains little medium : sand and medium silt.
7	: <u>Variable - Graded from Gravel to Coarse Silt.</u> Contains : little medium silt.
8	: <u>Uniform Coarse to Medium Silt.</u> - Contains little fine sand : and fine silt.
9	: <u>Variable - Graded from Gravel to Medium Silt.</u> - Contains : little fine silt.
10	: <u>Uniform Medium to Fine Silt.</u> - Contains little coarse silt : and coarse clay. Possesses behavior characteristics of silt.
10C	: <u>Uniform Medium Silt to Coarse Clay.</u> - Contains little coarse : silt and medium clay. Possesses behavior characteristics of : clay.
11	: <u>Variable - Graded from Gravel or Coarse Sand to Fine Silt.</u> : Contains little coarse clay.
12	: <u>Uniform Fine Silt to Medium Clay.</u> - Contains little medium : silt and fine clay (colloids). Possesses behavior : characteristics of silt.
12C	: <u>Uniform Clay.</u> - Contains little silt. Possesses behavior : characteristics of clay.
13	: <u>Variable - Graded from Coarse Sand to Clay.</u> - Contains little : fine clay (colloids). Possesses behavior characteristics : of silt.
13C	: <u>Variable Clay.</u> - Graded from sand to fine clay (colloids). : Possesses behavior characteristics of clay.

L



1-18. Liability and safety requirements. - a. The Area Engineer shall be responsible that his employees strictly observe the laws of the United States affecting all operations at the site under the project. He shall comply with all applicable Federal and state laws under which he is operating, including those concerning the inspection of boilers, hulls, and other equipment, the licensing of engineers, masters and other employees.

b. The Area Engineer shall conduct the work with due regard to adequate safety and sanitary requirements and shall maintain his plant and equipment in safe condition. He shall conform to current safety engineering practices as set forth in the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America; the publications of the National Safety Council, and with all applicable state or local safety and sanitary laws, regulations and ordinances.

c. The District Engineer will require such safety and sanitary measures to be taken as the nature of the work and the conditions under which it is to be performed, demand. Such measures shall include:

(1) The provisions of adequate extinguishers or fire-fighting apparatus in and about all buildings and plant erected or used at the site of the work;

(2) Adequate first aid and life-saving equipment;

(3) Adequate illumination during night operations;

(4) Watchmen service at any railroad crossings used by employees for access to the site;

(5) Warning lights between sunset and sunrise and during fogs, on all cofferdams, vessels, range piles and other obstructions placed in navigable waters during the progress of the work;

(6) Instruction in accident prevention to reach all employees;

(7) Such machinery guards, safe walkways, scaffolds, ladders, bridges, gang planks and other safety devices, equipment and apparel as are necessary to prevent accidents or injuries.

d. The Area Engineer shall report promptly to the District Engineer in form prescribed by him all accidents occurring at the site of the work.

1-19. Use of explosives. - All blasting shall be done in the most careful manner so as not to endanger life, property, or the work. Explosives used shall be of a quality and power approved by the District Engineer. Dynamite in a frozen condition shall not be used. Approved

explosives shall be stored before use in a suitable magazine, in an approved location, in compliance with state and local laws and regulations. Detonators shall be kept in a separate magazine not less than 100 feet from the explosives magazine. Magazines shall be plainly marked with large letters "EXPLOSIVES - DANGEROUS" and shall be kept locked. Accurate daily records shall be kept to account for each piece of explosive and detonator from the time of delivery at the magazine until its discharge in use.

1-20. Order of work. - The work covered by these specifications shall be commenced on the date designated by the District Engineer and shall be completed on or before June 30, 1939. In the pursuance of the work covered by these specifications, no money shall be expended on the construction of the project until the state, political subdivisions thereof, or other responsible agencies have given assurances satisfactory to the Secretary of War that the required easements and rights of way have been furnished according to the provisions of Paragraph 1-09. The work shall be carried on at such localities and in such order of precedence as may be found necessary by the District Engineer. The location and limits of the work to be done will be plainly indicated by the District Engineer or his agents by stakes or otherwise. The District Engineer may suspend the work wholly or in part for such periods as he may deem necessary on account of conditions considered unfavorable for the suitable prosecution of the work. Proper lights each night, between the hours of sunset and sunrise, shall be maintained on or about the site of the work as the District Engineer deems necessary for the proper conduct and inspection of the work and the safety of employees when night work is performed. Danger lights and barricades shall be placed, in accordance with the laws of the State of Connecticut, on all intercepted highways and on such obstructions and hazards which encroach on, or are adjacent to, public rights of way.

1-21. Plant organization. - a. The Area Engineer shall provide sufficient plant of size suitable to meet the requirements of the work and shall maintain the plant and equipment in such condition to perform the work efficiently and economically within the time specified. An ample force shall be maintained to properly and efficiently conduct the work.

b. No reduction in the capacity of the plant employed on the work shall be made except when approved by the District Engineer. The measure of the "capacity of the plant" shall be its actual performance on the work to which these specifications apply.

1-22. Employment of labor. - The method of employment, rate of wages, and monthly hours of employment for the various classifications of workmen shall be in strict conformity with the schedule (or any authorized revision thereof) furnished by the Works Progress Administration for Hartford. The District Engineer will report to the Department of Labor monthly within five days after the close of each calendar month on

forms to be furnished by the Department of Labor, the number of persons employed on the project, the man-hours worked and the total expenditure for materials. No work shall be done on Sundays or on days declared by Congress as holidays for per diem employees of the United States except in cases of emergency, and then only with the written consent of the District Engineer. Night work, when necessary to maintain operating schedules, will be permitted upon written approval of the District Engineer. (see Paragraph 1-20).

1-23. Purchase of supplies and materials. - a. Because the materials listed below, or the materials from which they are manufactured, are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, their use in the work herein specified (subject to the requirements of the specifications) is authorized without regard to the country of origin:

Platinum	Rubber	Balsa wood
Chromium	Teakwood	English ball clay
Cork	Silk	English china clay
Jute	Sisal	Natural nickel copper
Kauri gum	Tin	alloy (monel metal)
Lac	Asbestos	
Nickel	China wood oil (tung oil)	

b. Articles, materials, or supplies, manufactured in the United States and containing mercury, antimony, tungsten, or mica of foreign origin may be used (subject to the requirements of the specifications) in the work herein specified because such manufactured articles, materials, or supplies have been manufactured in the United States substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States.

1-24. Quality and inspection of supplies and materials. - a. All materials, supplies and articles used will be, insofar as is practicable, the standard stock products of recognized and reputable manufacturers and will be sufficient in strength, durability, usefulness and convenience for the purpose intended. All materials, parts and equipment shall be of the highest grade, free from defects and imperfections, of recent manufacture and unused. Workmanship shall be of the highest grade and in accordance with best modern practice.

b. All materials, supplies, and parts and assemblies thereof, purchased for the work covered by these specifications, shall be inspected in conformity with modern approved methods as directed by the District Engineer. Unless waived in writing by the District Engineer, all tests and trials shall be made in the presence of a duly authorized representative of the District Engineer. When the presence of the inspector is so waived, sworn statements, in duplicate, of the tests made and results thereof shall be furnished the District Engineer by the

supplier. All costs of all tests and trials excepting the expenses of the Government inspector shall be borne by the supplier and shall be included in the price bid.

1-25. Cost accounting. - a. The Area Engineer shall keep an accurate cost distribution record of all work done and shall submit a monthly cost report to the District Engineer. The cost shall be kept so that proper charges may be made against the items in Paragraph 1-07.

b. A separate account shall be kept of all labor charges in order that employees' compensation insurance may be determined.

c. The cost and expense of inspection and surveys shall be kept separately and not included in the actual cost of performing the work.

d. Prior to the commencement of the work, the Area Engineer shall prepare a Job Estimate Summary sheet (Form No. 18 Costs) in quadruplicate and forward same to the District Engineer, attaching thereto the engineering estimate for performing the work. The engineering estimate shall be prepared in a manner similar to that set forth in Paragraphs 734.1, 734.2, and 734.3 of Orders and Regulations. The final cost shall reflect all charges contemplated in the estimate.

e. Nothing in this paragraph shall be construed as changing the method by which costs are now reported in monthly and annual reports required by the Cost keeping manual.

1-26. Protection of existing structures. a. - During construction operations, on work covered by these specifications, the Area Engineer shall protect all existing structures and accepted work. Any disturbances or damage to any structures by operations under these specifications shall be repaired promptly by the Area Engineer without credit to the work.

b. The Area Engineer shall arrange his construction operations and the local features of the work, to avoid interference with the present or future development of the police pistol range as shown on the drawings. The Area Engineer shall interview the proper local authorities and make adequate adjustment of construction details required to protect the existing structure.

1-27. Final examination and acceptance. - As soon as practicable after the completion of any section of the work as in the opinion of the District Engineer will not be subject to injury by further operations under these specifications, such section may be examined as deemed advisable by the District Engineer. The District Engineer will make a thorough examination of same and if it is found to comply fully with the requirements of the specifications, it will be accepted.

SECTION II. PREPARATION OF SITE (Item 1).

2-01. Work included. - Clearing, grubbing, and disposal of materials shall be done as directed by the District Engineer, within the limits shown on the drawings.

2-02. Clearing. - a. The areas to be cleared shall include, (1) the area within the limits of the foundation of the required earth dike, together with a 5-foot strip measured horizontally beyond and contiguous to the toe line on each side of the dike, (2) borrow areas, and (3) any other area designated by the District Engineer within the limits shown on the drawings.

b. Trees and other obstructions shall be removed by the Area Engineer from the sites of the proposed structures and of the borrow areas when and as directed by the District Engineer and may be removed from other areas only to the extent directed or permitted. The Area Engineer shall preserve and protect from injury all trees not required to be removed.

c. All timber, undergrowth, brush, logs, weeds, and debris of any nature shall be cleared and removed. Trees and brush 4 inches in diameter or less shall be cut at the ground surface. Trees exceeding 4 inches in diameter shall be cut not more than one foot above the ground.

2-03. Grubbing. - a. The areas to be grubbed shall include the areas previously cleared, as may be directed by the District Engineer.

b. All such areas shall be thoroughly grubbed of all stumps, roots, buried logs and other objectionable matter. Tap roots and other projections over 1-1/2 inches in diameter shall be grubbed out to a depth at least 3 feet below the ground surface, unless otherwise directed by the District Engineer.

2-04. Removal of structures. - The removal of existing structures and utilities required to permit the orderly prosecution of the work covered by these specifications shall be accomplished by local agencies in a manner as directed by the Area Engineer and satisfactory to the District Engineer. Whenever a telephone or telegraph pole, pipe line, conduit, sewer or other utility is encountered and must be removed to permit completion of the work, the District Engineer will notify the proper local authorities, who shall take prompt action to have the designated utility expeditiously removed.

2-05. Disposal of materials. - All materials removed, as specified above, shall be disposed of by burning or by removal to approved disposal areas as directed. No material shall be thrown into, or left along the bank of the river. The disposal of material shall closely follow the operations of clearing and grubbing so that brush and other debris will not be washed into the river in case of high water. At no time shall material be placed on land adjacent to the construction area. No damage

of any nature shall be inflicted upon adjoining property owners by unwarranted entry or disposal of material on adjacent property.

2-06. Credit. - Credit for all work in connection with the preparation of the site as above specified, including the loading, hauling, and disposal of the materials, will be made by the acre under Item 1, "Preparation of Site".

SECTION III. EXCAVATION (Items 2 to 6 incl.)

3-01. Classification. - All materials excavated will be classified as follows:

a. Common excavation shall include all earth, clay, sand, gravel, and topsoil as defined below, also such hard and compact materials as hardpan, cemented gravel, shale and soft or disintegrated rock that can be removed by hand, power shovels, or draglines without continuous and systematic blasting, and also all boulders and detached pieces of solid rock less than 1/2 cubic yard in volume.

b. The words "soil" or "topsoil" shall mean the material composing the surface layers of the ground containing varying amounts of organic matter.

c. Detailed classification is as follows:

(1) Stripping (Item 2). (See Paragraph 3-02).

(2) Common Excavation (See Paragraphs 3-03 to 3-06 incl.)

General (Item 3).

Borrow Area (Item 4).

Toe-drain Trench (Item 5).

Impervious Blanket (Item 6).

3-02. Stripping (Item 2). - a. Work included. - (1) The Area Engineer shall strip the area occupied by the earth dike as shown on the drawings or directed by the District Engineer to a sufficient depth to remove all material not suitable for the foundation of the dike as determined by the District Engineer. The unsuitable materials to be removed shall include sod, topsoil, rubbish below the ground surface not removed by clearing and grubbing, all loose, weathered or otherwise unsatisfactory rock and any other objectionable material.

(2) Topsoil and sod obtained from the stripping operations shall be stock-piled in an approved location to be used later in dressing earth dike slopes, unless otherwise authorized by the District Engineer.

b. Disposal of materials. - The Area Engineer shall deposit suitable excavated materials in the required embankments as directed by the District Engineer, and shall waste in spoil areas in approved locations materials from the excavation that are unacceptable for use in the embankments as directed by the District Engineer. Materials, if any, which cannot be placed at once in permanent positions, may be deposited in storage piles at locations designated. The materials to be excavated from such storage piles will not again be credited as excavation.

d. Measurement and credit. - Measurement will be made by the cubic yard for the amount of material actually removed to the specified lines and grades or as directed by the District Engineer. Credit for all work in connection with stripping, including the loading, hauling, disposal of the materials, and any rehandling required, will be made by the cubic yard under Item 2, "Stripping".

3-03. Common excavation-general. - (Item 3). - a. Work included. - (1) The Area Engineer shall excavate and dispose of the materials classified as common excavation above and below the mean water level in the river to the lines and grades shown on the drawings for the respective areas, or as otherwise directed by the District Engineer. Common excavation includes excavation for the foundation of the earth dike additional to that included under Items 1 and 2, and any other required common excavation for structures, drains and ditches not included in other items of the work.

b. Description. - (1) General. - Excavation shall be performed in accordance with a schedule of operations to be approved by the District Engineer.

(2) Structure excavation. - Excavations shall be made wide enough to permit proper sheeting, bracing and form work where necessary.

c. Shoring. - The Area Engineer shall be responsible for the unfinished work, and that workmen shall be safe from danger of caving or slides while making structure excavations. Shoring may be used at the option of the Area Engineer. Where shoring is used in excavation for structures in lieu of excavation to full dimensions of the credit lines, an estimate for excavation will be made as though the cut had been made to the credit lines indicated on the drawings. Credit will not be made for shoring as such, but all costs thereof shall be included in the cost of excavation. If shoring is necessary and the Area Engineer does not use it, its use will be ordered by the District Engineer. Subject to the approval of the District Engineer shoring shall be erected in a safe and workmanlike manner, and shall be placed in such a way as to afford ready inspection of and ample clearance for the permanent work. Shoring shall be removed as directed by the District Engineer, upon completion of the permanent work or as soon as the construction does not require its use.

d. Disposal of materials. - As directed by the District Engineer all suitable materials excavated under Item 3 shall be placed in the earth dike or miscellaneous fills. Excavated materials not used in such construction may be used by the Area Engineer in temporary construction if approved by the District Engineer or shall be disposed of otherwise in designated spoil areas as provided in Paragraph 3-02 c.

e. Measurement and credit. - See Paragraph 3-05 d.

3-04. Common excavation - borrow areas (Item 4). - a. Work included. - The Area Engineer shall excavate under Item 4, in the existing dike and in the indicated borrow areas or other approved areas, the materials to be used in the dikes or miscellaneous fills. The District Engineer will specify the location in the borrow areas and the depth to which excavation shall be made. Excavations shall include the transportation of the material to the point of disposal. Borrow excavation shall include the stripping of the areas and disposal of objectionable topsoil containing roots or other debris, and the removal and the disposal of any other objectionable material so designated by the District Engineer. To provide suitable fill materials excavations shall be made to the depths and in the locations as directed by the District Engineer. The borrow areas shall be graded so that all surface water will readily drain from the areas at all times, and after excavation shall be graded so that the surfaces shall blend into the surrounding topography. The borrow areas shall be left in a neat and sightly condition satisfactory to the District Engineer.

b. Description. - Under Item 4 shall be included the excavation from the borrow areas shown on the drawings. The limit of excavation in the vicinity of the earth dike shall be as directed by the District Engineer. No borrow pit excavations will be permitted within 100 feet of the toes of the dike.

c. Disposal of materials. - The provisions of Paragraph 3-03 c. shall apply.

d. Measurement and credit. - See Paragraph 3-05 d.

3-05. Common excavation - toe-drain trench (Item 5). - a. Work included. - The Area Engineer shall excavate and dispose of the materials in the trench at the landside toe of the earth dike, both above and below the mean water level in the river to the lines and grades shown on the drawings, or as otherwise directed by the District Engineer.

b. Disposal of materials. - The provisions of Paragraph 3-02 c shall apply. Excavated material shall be placed in the dike section adjacent to the toe-drain trench as indicated on the drawings or as directed by the District Engineer.

c. Measurement and credit. - Measurement for excavation work under Items 3 to 5, inclusive, will be by the cubic yard for the amount of material actually removed to the lines and grades shown on the drawings or as staked in the field by the District Engineer. Measurement will be made for the volume in place before excavation (see Paragraph 4-14 b). Credit for all work in connection with excavation under Items 3 to 5, inclusive, including the loading, hauling, and disposal of the materials, will be made by the cubic yard under Items 3, 4, and 5, respectively, for the several items of excavation (see Paragraph 1-07).

3-06. Common excavation - impervious blanket (Item 6). - a. Work included. - The Area Engineer shall excavate the existing impervious blanket on the river side of the existing earth dike, to the lines and grades as shown on the drawings or directed by the District Engineer.

b. Description. - The extent and depth to which excavation shall be made will be as shown on the drawings or as determined in the field. Removal of the present inadequate impervious blanket is required to prepare the embankment slope to receive the new impervious blanket constructed of satisfactory material and thickness. Excavation shall be performed in accordance with a schedule of operations to be approved by the District Engineer.

c. Disposal of materials. - The excavated materials shall be disposed of in accordance with Paragraph 3-03 d.

d. Measurement and credit. - The applicable provisions of Paragraph 3-05 d shall apply to Item 6.

SECTION IV. EARTH DIKE (Items 7 and 8).

4-01. Definitions. - a. The term "embankment" as used in these specifications includes earth fill of all types for the earth dike and all other specified or directed earth fills within the limits of the dike necessary to complete the embankment. As shown on the drawings, the various types of earth fill are "selected impervious" under Item 7 for the blanket on the river side of the embankment; and the "pervious" under Item 8 forming the land-side shoulder of the embankment (see Paragraph 5-04).

b. Refer to Paragraph 1-02.

4-02. Work included. - The Area Engineer shall grade and consolidate materials required for the embankment, to the elevation, lines, grades and cross sections shown on the drawings, with such increased height and width as may be deemed necessary to the District Engineer to allow for later shrinkage or settlement. The Area Engineer shall use suitable materials as approved by the District Engineer and excavated from the required excavations and borrow areas shown on the drawings.

4-03. Materials. - a. General. - All materials from required excavations will be used, if, as excavation proceeds, they are found suitable by the District Engineer for use in the embankment. Brush, roots, sod, any type of organic materials, and other perishable or unsuitable material as determined by the District Engineer shall not be placed in the embankment. Materials shall not be wasted except by specific instructions from the District Engineer.

b. Borrow. - Other suitable materials shall be borrowed from locations shown on the drawings in accordance with Paragraphs 1-15 and 3-04. The origin of any material from either required or borrow excavations does not definitely determine where it will be used in the embankment. Materials from two or more excavation or borrow areas may be required to be used at the same time and in the same part of the embankment, mixing being done in the process of placing by systematic dumping, spreading and bulldozing. Materials from one area may be required to be used in different parts of the embankment.

c. Test requirements. - The various types of earth fill defined in Paragraph 4-01 shall conform to the test requirements and approved classification established by the Soils Laboratory, U. S. Engineer Office, Providence, Rhode Island. All test samples shall be taken under the supervision of the District Engineer and supplied to the Soils Laboratory by the Area Engineer. Subject to the approval of the District Engineer, the Area Engineer shall supply test samples in sufficient amount and frequency to give a comprehensive knowledge of the material and its placement and compaction in each section of the embankment.

4-04. Plowing. - Immediately prior to the placing of materials in the embankment, and after stripping has been completed (see Paragraph 3-02), the entire foundation of the embankment shall be thoroughly plowed and broken to a depth of 4 inches. The furrows shall run approximately parallel to the axis of the embankment. All roots, stones, and debris or other objectionable material shall be removed and disposed of as directed by the District Engineer. The condition of the surface material of the foundation area at the time of plowing shall be slightly drier than the required moisture content for rolled fill. Plowing shall be completed not less than 200 feet in advance of the embankment construction. After plowing, the entire surface of the foundation area shall be rolled in accordance with Paragraph 4-06 d.

4-05. Filling of excavations in embankment area. - a. General. - The test pits, gullies and other excavated areas within the limits of the embankment and as otherwise shown on the drawings shall be filled with pervious, random (see Paragraph 5-04), or impervious materials as directed by the District Engineer. The fill shall be placed in layers, moistened, and rolled in accordance with Paragraph 4-06 whenever, in the opinion of the District Engineer, it is possible to do so. Material which cannot be compacted by roller equipment on account of clearances, shall be spread in 2-inch layers and compacted with hand or power tampers which shall give the degree of compaction required for the embankment. As the fill is brought up, the side slopes of the cut or hole shall be scarified by equipment or by hand if it is required, in the opinion of the District Engineer, in order to provide a bond between the fill and the original ground materials.

b. Holes and gullies. - The sides of holes and gullies shall be broken down with bulldozers or a disc harrow so as to flatten out the slopes, and the hole then filled with approved material and properly rolled or tamped in place (see Paragraph 5-04).

4-06. Rolled fill. - a. General. - The selected impervious and pervious sections of the embankment shall be constructed with a crown running with the center line of the dike and with slopes approximately on a 2 per cent grade toward the edges of the embankment. This slope shall be maintained until the completion of the embankment, thus bringing up together the impervious and pervious sections. As soon as practicable, in the opinion of the District Engineer, the embankment shall be brought to a nearly uniform grade for each section of dike under construction. Subject to the approval of the District Engineer, the embankment construction shall proceed in sections of not less than 1,000 feet in length, and each section shall be carefully bonded to the preceding section.

b. Furnishing and placing. - (1) The Area Engineer may use power shovels, drag lines, or any type of excavating machinery which is capable of excavating the materials in dry condition. The Area Engineer may use any approved method of transporting materials in natural dry condition to the embankment. The dumping of the suc-

cessive loads shall be at locations as directed by the District Engineer. Sufficient excavating and hauling equipment shall be available so that not less than two sources of material can be worked at the same time. When two or more different materials are being moved into a section of the embankment they shall be spotted and dumped systematically so that in any area of the section there are approximately the required proportions of the materials. After dumping, the materials for the impervious and random sections shall be bulldozed or otherwise spread in approximately 8-inch layers and rolled. The materials for the pervious section shall be spread in approximately 12-inch layers and rolled (see Paragraph 4-06 d.). Should the material for the various sections of the embankment be too high in water content when dumped, it shall be bulldozed or otherwise spread and harrowed or stirred, and left for a sufficient time to allow the surplus water to dry out before being rolled. If, in the opinion of the District Engineer, the rolled surface of any layer of the materials is too smooth to bond properly with the succeeding layer or, if the materials have dried out sufficiently to cause cracks in the surface, it shall be roughened or loosened by a disc harrow, or other approved means, and dampened, if required, before the succeeding layer is placed thereon. All roots, trash, and debris shall be promptly removed from the embankment and disposed of to the satisfaction of the District Engineer. Stones greater than 6 inches in diameter shall be removed from the impervious and random sections and when approved by the District Engineer, shall be placed in the pervious section of the embankment. The entire surface of the embankment shall be maintained in such condition that construction equipment can travel thereon. Routing of construction equipment on the embankment shall be subject to direction by the District Engineer.

(2) Any embankment material lost or loosened, after being placed in the embankment and before the completion and acceptance of the completed work, because of floods or other actions of the river, or because of any construction operation or for other causes, shall be replaced to the satisfaction of the District Engineer.

(3) The Area Engineer shall cease work on the embankment at any time when, in the opinion of the District Engineer, satisfactory work cannot be done on account of rain, high water, cold weather, or other unsatisfactory conditions.

c. Moisture control. - To obtain the desired degree of compaction for the varying kinds of materials used, the moisture content of the material being placed shall be the optimum required for satisfactory compaction. If required, the compacted surface shall be sprinkled as directed immediately before placing each new layer. The moisture content shall be sufficient to dampen the filled materials as required, but the amount of sprinkling shall be controlled so that no free water will appear on the surface during or subsequent to the rolling. An adequate supply of water shall be available. Jets shall not be directed at the embankment material with such force that the finer materials are washed out.

d. Compaction. - (1) Tamper type roller. - Rolling for the impervious and random sections of the embankment shall be done by a tamper type twin roller such as a "sheeps-foot" roller, water or sand ballasted, having tamping feet uniformly staggered over its cylindrical surface, and equipped with cleaners; or other satisfactory type of tamper roller as approved by the District Engineer. Each tamping foot shall project approximately 7 inches from the roller's cylindrical surface and shall have a face area of not less than 5 and not more than 7 square inches. The spacing shall be such as to provide a minimum of two tamping feet for each square foot of cylindrical surface. Addition or reduction in the number of tamping feet shall be made when directed by the District Engineer. The total weight of the roller in pounds divided by the total area of the maximum number of tamping feet in one row parallel to the axis of the roller shall be not less than 115 pounds per square inch tamping foot area with the drum empty, and not less than 200 pounds per square inch tamping foot area with the drum ballasted. The design and operation of the tamping roller shall be subject to the approval of the District Engineer.

(2) Rolling impervious and random sections. - When the moisture content and condition of the spread impervious and random layers of the embankment are satisfactory to the District Engineer, they shall be rolled with tamper type twin rollers. The twin rollers shall be pulled by a crawler type tractor of suitable power, weighing not less than 20,000 pounds, manufacturer's standard weight, at a speed of approximately 2-1/2 miles per hour. Each square foot of each layer of the embankment material shall be compacted by not less than six passes of the rollers. Additional passes of the rollers shall be made if necessary to obtain the required compaction. Successive trips of rollers shall overlap by at least 2 feet. Failure to comply with this requirement for careful rolling will be a cause for additional trips. Where new material abuts old material, either in place or in embankment, the old material shall be cut or broken by machine or hand methods approved by the District Engineer, until it shows the characteristic colors of undried materials, and the rollers shall work on both materials, bonding them together. Portions of the earth fill which the roller cannot reach for any reason shall be thoroughly compacted by tamping with hand or power tampers in 2-inch layers. The degree of compaction for such portions of the earth fill shall be equivalent to that obtained by sprinkling and rolling as specified for the other portions of the earth fill.

(3) Rolling pervious section. - Rolling of the pervious section of the embankment shall be the same as specified above except that a minimum of 3 passes of the rollers will be required. If, in the opinion of the District Engineer, better compaction can be obtained by the use of a plain cylindrical roller, or a Parson's disc tamping roller, the use of such a roller may be required. The disc tamping roller shall weigh not less than 1100 pounds per linear foot. When conditions of the work so require, at the direction of the District Engineer, rolling may be done by a crawler type tractor weighing not less than 20,000 pounds; in such cases a minimum of four passes of the tractor treads on each square foot of embankment area will be required.

(4) Tests for compaction. - Samples of all embankment materials for testing, both before and after placing and compaction, will be taken at frequent intervals under the supervision of the District Engineer. Corrections, adjustments and modifications of methods, selection of materials and moisture content will be made from these tests to secure maximum density of the materials in the embankment (see Paragraph 4-03 c.).

e. Impervious fill. - Impervious fill shall be selected and secured from required excavations and borrow pits as directed by the District Engineer and shall be placed in the impervious section of the embankment throughout the entire length.

f. Random fill. - Random fill will consist of pervious material excavated as directed by the District Engineer. It shall be used to backfill gullies eroded in the pervious section of the embankment (see Paragraph 5-04).

g. Pervious fill. - The pervious fill shall be selected and secured from required excavations and borrow pits as directed by the District Engineer, and shall be placed in the pervious sections of the embankment. The pervious section of the embankment shall be graded from the finer materials near the impervious blanket to the coarser materials near the land-side face of the embankment. Special care shall be taken to place the coarser material and cobbles adjacent to the land-side face of the embankment.

4-07. Removal of objectionable material. - The Area Engineer shall excavate, remove and dispose of any material from the embankment sections which the District Engineer considers objectionable in such locations, and refill the area as directed in accordance with Paragraph 4-05.

4-08. Slides. - In case of slides in any part of the embankment during the construction or after completion, but prior to the final acceptance of the work, the Area Engineer shall cut out and remove the area specified by the District Engineer and then rebuild the excavated area in accordance with these specifications.

4-09. Frozen materials. - No earth shall be placed upon a frozen surface, nor shall frozen earth, snow or ice be placed in the embankment. In cases of emergency the District Engineer may require frozen material to be stock-piled for later use in the embankment.

4-10. Shrinkage or settlement. - The Area Engineer shall assume all responsibility for placing excess embankment material required by shrinkage or settlement during construction insofar as credit for fill in embankment is concerned, as such quantities are not deemed determinate. Excavation of excess materials from the borrow pits required by settlement and shrinkage will be included in the credit to the work at the applicable credit item.

4-11. Temporary drains and ditches. - The Area Engineer shall maintain the site of the work and the grounds immediately adjacent thereto, free from collected surface water if, in the opinion of the District Engineer such collected water affects the safety or condition of the work. Such temporary drains and ditches shall be constructed as are deemed necessary and directed by the District Engineer.

4-12. Top soil and sodding. - a. Placing top soil. - Unless otherwise authorized by the District Engineer, a suitable top soil shall be placed on the crown and slopes of the earth dike as shown on the drawings. Credit for placing top soil will be allowed under Item 17 (see Paragraph 8-01).

b. The areas upon which top soil has been placed shall be sodded or seeded as specified in Paragraph 8-01. Credit for seeding and sodding will be allowed under Item 18.

4-13. Gravel for top of dike. - Unless otherwise directed by the District Engineer, the top of the dike shall be surfaced with a layer of gravel as shown on the drawings. Credit for placing the gravel surfacing will be allowed under Item 19 (see Paragraph 8-02).

4-14. Measurement and credit. - a. The quantities to be credited under Items 7 and 8 will be the number of cubic yards placed as directed, measured in place after compacting. Credit shall include the work of preparing the base, spreading in layers, wetting, rolling or tamping, trimming to line, and shall include all labor and materials incidental to completing the embankment, not specifically included under other items. Credit will be made by the cubic yard under Items 7 and 8 as applicable (see Paragraph 1-07).

b. To determine the quantities for which credit will be allowed, a survey will be conducted prior to the beginning of the work. The true surface condition will be shown by cross sections and profile and the measurement of the quantities will be based upon this survey. The quantities will be the volume between the original surface at the beginning of the work and the slope lines and grades as indicated on the drawings, as staked in the field or as directed by the District Engineer, at the completion of the work.

c. Additional credit will be allowed to replace embankment washed out by flooding or scouring, or that required to be removed on account of slides, or the removal and disposal of all objectionable materials placed at the direction of the District Engineer; provided such replacement of embankment was not caused by negligence or carelessness of the Area Engineer. Quantities for additional credit will be measured as directed by the District Engineer.

SECTION V. MISCELLANEOUS FILL AND BACKFILL (Items 9 to 11 incl.)

5-01. Definitions. - The term "gravel bedding" includes the gravel backfill over the tile drains as shown on the drawings, and the gravel required for filters. "Semi-compacted backfill" refers to miscellaneous backfill not completely compacted. "Random Fill" refers to pervious material required to backfill gullies eroded in the pervious section of the earth dike (see Paragraph 1-02).

5-02. Gravel Bedding (Item 9). - a. Work included. - As shown on the drawings or as directed the Area Engineer shall place, in the locations designated, backfill of gravel over the tile drains. The Area Engineer shall also place a layer of gravel of the specified quality required for filters at the locations shown on the drawings or as directed by the District Engineer.

b. Materials. - Gravel bedding shall consist of suitable coarse clean gravel of which, unless otherwise directed, not more than ten per cent by weight will pass a No. 10 sieve. The gravel shall all pass a 2-inch square mesh screen and shall be satisfactorily graded. The material shall be obtained from approved commercial sources, be screened, and placed directly in position and consolidated by wetting to the extent directed.

c. Placing. - The material shall be placed as shown on the drawings or as directed, and with such hand-placing as may be necessary to trim to the required slopes. The Area Engineer will not be required to tamp or roll the material, but will be required to consolidate it with water to the extent directed so that no settlement or voids will later result.

d. Measurement and credit. - Measurement will be made by the cubic yard for the amount of gravel placed in the completed work to the lines and grades shown on the drawings or as directed by the District Engineer. Credit for all work in connection with gravel bedding will be made by the cubic yard under Item 9, "Gravel Bedding."

5-03. Semi-compacted backfill (Item 10). - a. Work included. - The Area Engineer shall place, grade and consolidate materials required for miscellaneous backfill over pipe drains and culverts, and at other locations as directed by the District Engineer. The material shall be placed in 12-inch horizontal layers with only such hand placing as may be necessary to trim to the required slopes. The Area Engineer will not be required to roll the material, but will be required to consolidate it with water to the extent directed so that no settlement or voids will later result. Hand tamping shall be done where required by the District Engineer.

b. Materials. - Materials shall be borrowed from locations shown on the drawings in accordance with Paragraph 1-15, or may be obtained from required excavations. Backfill material shall be free from

stumps, roots, sod, rubbish or other unsuitable materials or substances.

c. Measurement and credit. - Measurement will be made by the cubic yard for the amount of semi-compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the District Engineer. Quantities will be measured in place after any settlement. Credit for all work in connection with furnishing and placing semi-compacted backfill will be made by the cubic yard under Item 11, "Semi-compacted Backfill."

5-04. Random fill (Item 11). - a. Work included. - The Area Engineer shall place, grade and consolidate suitable materials for "random fill" in the gullies eroded in the land-side slope of the earth dike. The work shall be done as directed by the District Engineer (see Paragraph 1-02).

b. Description. - (1) Gullies more than one foot deep shall be cut down and backfilled with suitable materials for random fill (see Paragraph 4-05), to the lines and grades as directed. Topsoil and sodding shall be done as provided for in Paragraphs 4-12 and 8-01.

(2) Random fill shall be placed in approximately 8-inch layers, and shall be thoroughly compacted and bonded to the adjacent materials of the embankment by rollers or other equipment, to the extent and in a manner approved by the District Engineer.

(3) If practicable in the opinion of the District Engineer, placing and compacting of the random fill for repairing gullies shall be done as specified in Paragraph 4-06, unless otherwise directed by the District Engineer.

c. Materials. - Materials shall be obtained from required excavations or from approved borrow areas subject to the approval of the District Engineer.

d. Measurement and credit. - The quantity to be credited under Item 11 will be the number of cubic yards satisfactorily placed in accordance with the drawings or as directed by the District Engineer. Quantities will be measured as directed by the District Engineer. Credit shall include all costs of cutting down the gullies, placing and compacting the backfill, and other incidental work (see Paragraph 4-14).

SECTION VI. DRAINS (Items 12 to 15 incl.)

6-01. Definitions. - Drains shall include "Tile Drains", Item 12, required for the toe-drain, and to connect the toe drain of the earth dike to the drainage ditch as shown on the drawings; "Grouted Stone Gutters", Item 13, required along the ramps as shown on the drawings; and "Corrugated Pipe", Item 14, and "Catch Basin Gratings", Item 15, required to complete the drainage system.

6-02. Tile Drains (Item 12). - a. Work included. - The Area Engineer shall furnish and lay tile pipes, including specials, of the required diameters for the drainage system on the land side of the earth dike as shown on the drawings.

b. Materials. - All pipes shall be bell-and-spigot, vitrified, salt-glazed, stoneware pipe conforming to the requirements of Federal Specification SS-P-361, or subsequent amendments or revisions thereof. Each pipe shall be carefully inspected immediately before laying and no cracked, broken or otherwise imperfect pipe shall be used, except for minor defects which in the opinion of the District Engineer do not impair the fitness of the pipe for the purpose intended.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraphs 3-03 and 3-05. Pipe trenches shall have a depth of not less than two feet and a width at least 12 inches greater than the outside diameter of the pipe. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom and for at least three inches up each side. All rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids backfilled with well compacted suitable material.

d. Laying pipe. - All pipe shall be placed in the trench immediately after the excavation is completed and the gravel bedding placed as shown on the drawings. Proper care shall be used in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded, and properly connected and jointed. Bell holes shall be excavated to insure that each pipe shall rest firmly upon its bed for the entire pipe length. The pipes shall be laid with open joints true to the lines and grades shown on the drawings or as staked in the field, with bells upgrade and with spigot ends fully entered in the bells. A strip of burlap at least 6 inches in width and 36 inches in length shall be carefully and securely wrapped around the pipe joints.

e. Backfilling. - Backfill material as shown on the drawings shall be evenly spread and compacted around and over the pipe to the limits shown on the drawings or as directed by the District Engineer (see Paragraphs 5-02 and 5-03).

f. Measurement and credit. - (1) Measurement for credit

will be based on the linear foot of pipe of the size installed. Credit for pipe will be made by the linear foot under Item 12, "Tile Drains", for the various sizes installed, and shall include all costs of furnishing and installing the pipe including specials, except the cost of excavation and backfilling.

(2) Credit for excavation will be made under Item 3 for lateral drains, or under Item 5 for the toe-drain (see Paragraph 3-05d). Credit for backfilling will be made under Items 9 and 10 as appropriate for the material used (see Paragraphs 5-02d and 5-03c).

6-03. Grouted stone gutters (Item 13). - a. Work included. -

(1) Hand-placed riprap shall be placed by the Area Engineer to the lines and grades shown on the drawings, for paving the gutters along the ramps at the locations shown on the drawings or elsewhere as directed by the District Engineer.

(2) The Area Engineer shall also furnish and place grout for surface grouting all hand-placed riprap in the gutters.

b. Material and placing. - (1) Riprap shall be of durable rock of acceptable sizes. Suitable rock from borrow pits, quarries and from the required excavations shall be used. The riprap shall be laid to the lines and grades shown on the drawings or as directed. The rock shall be hand-placed, to a tolerance of 1 inch above or below the finished surface shown on the drawings. No individual rock shall be less than 10 pounds or more than 30 pounds in weight, and at least 75 per cent of the rock used shall be at least 20 pounds in weight. The rock shall be closely laid on a base of gravel bedding (see Paragraph 5-02), with the proper dimension normal to the slope, and with joints broken where possible.

(2) Grouting shall be done on clean riprap surface with a grout mixture of 1 part Portland cement and 2-1/2 parts sand by volume combined with water to a suitable consistency. Cement and sand used in the grout shall be obtained from approved commercial sources and subject to the approval of the District Engineer (see Paragraph 7-02 b.). The grout shall be worked into the joints of the riprap surface with brooms or other means so as to fill the voids completely.

c. Measurement and credit. - The quantity to be credited under Item 13 will be the number of square yards of riprap placed to the specified lines and grades in the completed work. Credit shall include all costs for furnishing, hauling, placing and grouting the riprap. Credit will be made by the square yard under Item 13, "Grouted Stone Gutters."

6-04. 12-inch corrugated pipe (Item 14). - a. Work included. - The Area Engineer shall furnish and lay 12-inch diameter corrugated metal pipe, required for the drainage system on the land side of the earth dike as shown on the drawings.

b. Materials. - All pipe shall meet the requirements of Federal Specification QQ-C-806, as amended March 1936. No pipe sections will be accepted unless the metal is identified by a stamp showing name of manufacturer, name of plant, kind of base metal and gage number.

c. Excavation. - Excavation shall be as shown on the drawings and as provided for in Paragraph 3-03. Pipe trenches shall have a depth of not less than two feet and a width at least 12 inches greater than the outside diameter of the pipe. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom and for at least 3 inches up each side. All rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids backfilled with well compacted suitable material.

d. Laying pipe. - All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury. The pipe shall be carefully bedded, and properly connected and jointed. The pipes shall be laid true to the lines and grades shown on the drawings or as staked in the field. The interior of the pipe shall be carefully cleaned after laying to remove dirt and other obstructions.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be done in accordance with the provisions of Paragraph 5-03, unless otherwise shown on the drawings or directed by the District Engineer.

f. Measurement and credit. - (1) Measurement for credit will be based on the linear foot of pipe of the size installed. Credit for pipe will be made by the linear foot of 12-inch corrugated metal pipe installed, and shall include all costs of furnishing and installing the pipe except the cost of excavation, backfilling, and any concrete required.

(2) Credit for excavation will be allowed under Item 3 (see Paragraph 3-05 d). Credit for backfilling will be allowed under Item 10 (see Paragraph 5-03 e). Credit for concrete will be allowed under Item 16 (see Paragraph 7-06).

6-05. Catch basin gratings (Item 15). - a. Work included. - The Area Engineer shall furnish and install cast iron catch basin gratings as shown on the drawings or as directed by the District Engineer.

b. Iron castings. - (1) Quality of cast iron. - Cast iron catch basin covers shall be as detailed on the drawings or of standard size and shape suitable for the purpose, as approved by the District Engineer. The castings shall be of good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes and defects of every nature which would render them unfit

for the service for which they are intended. All castings shall be thoroughly cleaned and subject to careful hammer inspection. Castings shall conform at least to the provisions of Federal Specification QQ-I-651.

b. Painting castings. - Castings before being shipped from the foundry shall be given one coat of coal tar pitch varnish applied in a satisfactory manner so as to make a smooth coating, tough, tenacious and not brittle or with any tendency to scale off.

c. Measurement and credit. - a. Credit will be made by the pound under Item 15, "Catch Basin Gratings", and shall include all costs for furnishing and installing the catch basin gratings as required.

SECTION VII. CONCRETE (Item 16).

7-01. Work included. - a. The Area Engineer shall furnish and place Class "B" concrete containing 1-1/2-inch maximum size aggregate, required for miscellaneous structures, as shown on the drawings and in accordance with these specifications or modifications designated by the District Engineer.

b. Steel reinforcement and other metal work required for the complete installation shall be furnished and placed as shown on the drawings or as directed by the District Engineer.

7-02. Concrete. - a. Composition and strength. - Concrete shall be composed of cement, fine aggregate, coarse aggregate and water so proportioned and mixed as to produce a plastic, workable mixture suitable to the specific conditions of placement. The mixes will be designed to secure concrete having an average compressive strength of 3000 pounds per square inch at the age of 28 days, as determined by breaking standard 6-inch diameter by 12-inch height or 8-inch diameter by 16-inch height test specimens. Test specimens will be taken by the Government inspector as directed by the District Engineer.

b. Materials. - (1) Portland cement. - Cement shall conform to Federal Specification SS-C-206, for "Cement, Portland, Moderate-Heat-of-Hardening, September 30, 1936." Cement shall be a brand approved by the District Engineer in advance of its use on the work.

(2) Fine aggregate. - Fine aggregate shall be graded natural sand, secured from a commercial source and approved by the District Engineer in advance of its use on the work.

(3) Coarse aggregate. - Coarse aggregate shall be washed graded gravel or crushed stone, of 1-1/2-inch maximum size with not over 70 per cent by weight passing a 3/4-inch square mesh screen. Coarse aggregate shall be secured from a commercial source and approved by the District Engineer in advance of its use on the work.

(4) Water. - The water used in mixing concrete shall be fresh, clean and free from injurious amounts of oil, acid, alkali, or organic matter.

c. Proportioning. - (1) General. - All concrete materials will be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified. The exact proportions of all materials entering into the concrete shall be as directed by the District Engineer. The Area Engineer shall provide all equipment necessary to positively determine and control the actual amounts of all materials entering into the concrete. The proportions will be changed whenever in the opinion of the District Engineer such change becomes necessary to obtain the specified strength and the

desired density, uniformity and workability, and the work will not receive additional credit because of such changes.

(2) Measurement. - All materials shall be measured by weight except that water may be measured by volume when so authorized by the District Engineer. One bag of cement will be considered as 94 pounds in weight and 1 gallon of water as 8.33 pounds.

(3) Cement content. - Each cubic yard of concrete shall contain not less than 4.5 bags or 423 pounds of cement.

(4) Water content. - In calculating the total water content in any mix the amount of moisture carried on the surface of the aggregate particles shall be included. The total water content for a bag of cement for each batch of concrete shall not exceed 6.5 gallons or 54.1 pounds. In all cases, however, the amount of water to be used shall be the minimum amount necessary to produce a plastic mixture of the strength specified and of the desired density, uniformity and workability. In general, the consistency of any mix shall be that required for the specific placing conditions and methods of placement.

(5) Aggregate content. - The total volume of aggregates to be used in each cubic yard of concrete shall be that necessary to produce a dense mixture of the required workability as determined by the District Engineer.

d. Mixing and placing. - (1) Equipment at the site. - The Area Engineer shall provide at the site of the work an approved power driven mixer in good condition of adequate size for the work, or, the District Engineer may approve the use of truck mixed concrete from a commercial source. Adequate equipment and facilities will be provided for accurate measurement and control of all materials and for readily changing the proportions of materials to conform to the varying conditions of the work, in order to produce concrete of the required uniform strength and workability. The minimum time for mixing each batch, after all materials are in the mixer, shall be 1-1/4 minutes. The mixer shall revolve a minimum of 12 revolutions after all materials have been placed in it, and at a uniform speed. Neither speed nor volume capacity of the mixer shall exceed those recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted.

(2) Truck mixing. - (a). When truck mixed concrete is approved by the District Engineer the proportioning plant shall provide for the inspection of all operations at all times, with adequate facilities for accurate measurement and control of all materials and for readily changing the proportions of materials to conform to the varying conditions of the work, in order to produce concrete of the required uniform strength and workability. The size of the batch shall not exceed the maximum rated capacity of the mixer as stated by the manufacturer and as stamped in metal in a prominent place on the mixer.

The mixer shall be water-tight when closed. Each batch of concrete shall be mixed not less than 50 nor more than 150 revolutions of the mixer at the rate of rotation specified by the manufacturer as mixing speed. Additional mixing, if any, shall be done at a slower speed specified by the manufacturer for agitation. Except as subsequently provided, the truck mixer shall be equipped with a tank for carrying the mixer water. The water shall be measured and placed in the tank at the proportioning plant unless the tank is equipped with an automatic measuring device of the required accuracy and capable of being locked. The truck shall be equipped with a discharge chute and extension.

(b). Delivery. - Concrete shall be hauled in a water-tight container in which segregation will not take place, and from which concrete can be discharged freely, and shall be delivered to the work at the consistency specified.

(c). Time of hauling. - Concrete shall be delivered to the site of the work, and discharge from the hauling container shall be completed within a period of 45 minutes after the introduction of the mixing water to the cement and aggregates, or the cement to the aggregate when the fine aggregate contains moisture in excess of 6 per cent by weight and the coarse aggregate contains moisture in excess of 3 per cent by weight.

(d). Temperature. - Concrete delivered in outdoor temperatures lower than 40 degrees Fahrenheit (5 degrees Centigrade) shall arrive at the work having a temperature not less than 60 degrees Fahrenheit (15 degrees Centigrade), nor more than 100 degrees Fahrenheit (38 degrees Centigrade).

(3) Conveying. - Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position. Conveying of concrete by means of chutes will not be permitted except for short chutes in the forms to distribute the concrete. Chutes used shall be such that the concrete slides in them and does not flow. Chutes with a flatter slope than 1 on 2 will not be permitted. There shall be no free vertical drop greater than 5 feet except where specifically authorized by the District Engineer.

(4) Placing. - (a). Concrete shall be placed before initial set has occurred, and in no event after it has contained its water content for more than 45 minutes. All concrete shall be placed in the dry upon clean, damp surfaces, free from ice, frost or running water, and never upon soft mud, dry porous earth, or upon fills that have not been subjected to approved rolling, puddling or tamping so that ultimate settlement has occurred.

(b). All concrete shall be deposited in approximately horizontal layers not to exceed 24 inches in thickness unless otherwise specifically authorized or directed by the District Engineer, and the concreting shall be carried on as a continuous operation, as far as practicable, until the placing in the course, section or monolith is completed. In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. All top surfaces not covered by forms and which are not to be covered by additional concrete or backfill shall be carried slightly above grade and struck off by board screed.

(5) Construction joints. - Vertical joints shall be formed with tongue-and-groove bonds or keys at such locations and of such shapes and dimensions as approved or directed by the District Engineer. Horizontal joints shall be formed with keys, or, where horizontal pressure is always in one direction, with steps. Where required, dowel rods shall be used. All concrete in vertical members shall have been in place not less than 12 hours, and longer if so directed by the District Engineer, before concrete in horizontal members resting thereon is placed. As soon as practicable after placing and immediately before placing the succeeding layers is resumed, all approximately horizontal surfaces shall be washed with a high pressure air-and-water jet if available. Sand shall be added to the air-and-water jet when required, to remove alkali, algae, stains, and other substances injurious to the bond. The time and method of using the jet shall be such that all laitance, scum, etc. will be removed so that partly embedded aggregate is not disturbed and is washed clean. After final cleaning and immediately before placing is resumed, the surfaces shall be wetted and spread with a layer of mortar 1/2 inch thick, thoroughly brushed in. The mortar shall be the same cement-sand ratio as the concrete.

(6) Cold weather. - Concrete shall not be placed when the ambient atmospheric temperature is below 35 degrees Fahrenheit, nor when the concrete is likely to be subject to freezing temperatures before final set has occurred, unless specifically authorized by the District Engineer in writing.

(7) Hot weather. - For concrete placed during the extremely warm summer months and otherwise, when directed by the District Engineer, the aggregates shall be cooled by spraying in such manner as to utilize the cooling effect of evaporation. The mixing water shall be the coolest available at the site insofar as is practicable.

c. Finishing. - Immediately after placement, the concrete shall be properly forked back along the faces of all forms by the use of standard concrete forks or spades unless otherwise specifically authorized or directed by the District Engineer. The finished surfaces shall be free from sand streaks or other voids and the plastering over of such surfaces will not be permitted. Defective concrete shall be

repaired as directed by the District Engineer.

f. Curing. - All concrete shall be adequately protected from injurious action by the sun. Fresh concrete shall be protected from heavy rains, flowing water, and mechanical injury. All concrete shall be kept wet for a period of not less than 14 days unless otherwise directed by the District Engineer, by covering with an approved water-saturated covering, or any other approved method which will keep all surfaces continuously (not periodically) wet. Where wood forms are left in place for curing, they shall be kept wet at all times to prevent opening at the joints and drying out of the concrete. Water for curing shall be generally clean and entirely free from any elements which in the opinion of the District Engineer might cause staining or discoloration of the concrete.

7-03. Forms. - a. Materials. - Forms shall be of tongue-and-groove lumber of uniform width unless otherwise directed by the District Engineer. The type, size, shape, quality and strength of all materials of which the forms are made shall be subject to the approval of the District Engineer.

b. Construction. - Forms shall be built true to line and grade, and shall be mortar-tight and sufficiently rigid to prevent displacement or sagging between supports. Responsibility for their adequacy shall rest with the Area Engineer. Their surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all metal will be not less than 2 inches from any concrete surface. Wire ties will not be permitted where the concrete surface will be exposed to weathering and discoloration will be objectionable. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. Unless otherwise indicated, suitable moldings shall be placed to bevel or round exposed edges as may be required by the District Engineer.

c. Coating. - Forms for exposed surfaces shall be coated with a non-staining mineral oil which shall be applied shortly before the concrete is placed. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete.

d. Removal. - Forms shall be removed as directed by the District Engineer, and all removal shall be accomplished in such manner as will prevent injury to the concrete. Forms shall remain in place for a minimum period of 48 hours after the placing of the concrete, unless otherwise directed by the District Engineer. When, in the opinion of the District Engineer, conditions on the work are such as to justify it, forms may be required to remain in place for a longer period.

7-04. Furnishing, bending, and placing steel reinforcement. - a. General. - The Area Engineer shall furnish, cut, bend and build into

the concrete, in accordance with the drawings and directions, all steel reinforcement of deformed bars, dowels or anchors. Steel reinforcement may be cut and bent at the mill or in the field. All bending shall be in accordance with standard approved practice and by approved machine methods.

b. Materials. - Steel reinforcement shall be of new, billet intermediate grade, open-hearth steel, deformed, and shall conform to the Federal Specifications QQ-B-71a for "Bars, reinforcement, concrete, Type "B", Grade 2 (dated January 12, 1938). The steel shall be free from oil, paint, dirt or excessive rust.

c. Placing. - (1) All steel reinforcement shall be placed in the exact positions and with the spacing shown on the drawings or ordered, and it shall be so fastened in position as to prevent its becoming displaced during the placing of the concrete. The clear distance between parallel rods shall be not less than one and one-half times the diameter of round rods, or twice the side dimensions of square rods, and unless specifically authorized, shall in no case be less than 1 inch. Except where otherwise indicated, all main reinforcement shall be placed not less than 2 inches from any concrete surface. The covering of stirrups, spacer rods and similar secondary reinforcement may be reduced by the diameter of such rods. The above dimensions shall be measured from the face of the reinforcement to the face of the forms.

(2) Where splices in reinforcement, in addition to those indicated are necessary, there shall be sufficient lap to transfer the stress by bond as may be directed. Rods shall be lapped not less than 40 diameters and splices shall be staggered. The lapped ends of rods shall be connected properly to develop the full strength of rod.

7-05. Embedded items. - In addition to reinforcing steel, there shall be built into, or set, or attached to the concrete, pipes and other metal objects as shown on the drawings or required by the District Engineer. All necessary precautions shall be taken to prevent these objects from being displaced, broken or deformed. Before placing concrete, care shall be taken to determine that any embedded metal or wood parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from paint or other coating, rust, scale, oil, or any foreign matter. The embedding of wood in concrete shall be avoided whenever possible, metal being used instead. The concrete shall be packed tightly around pipes and other metal work so as to prevent leakage and secure perfect adhesion. Drains shall be adequately protected from intrusion of concrete into them.

7-06. Measurement and credit. - Credit will be allowed under Item 16 for the volume of concrete satisfactorily placed to the lines and grades shown on the drawings or directed by the District Engineer. Credit shall include payment for all materials, equipment, labor and incidental expense connected with placing the concrete, and doing all work described in Paragraphs 7-01 to 7-05 inclusive.

SECTION VIII. MISCELLANEOUS (Items 17 to 20 incl.)

8-01. Placing topsoil and sodding embankment slope (Items 17 and 18.). - a. Work included. - The Area Engineer shall furnish and place topsoil on the slopes of the earth dike as shown on the drawings, and on other areas as required by the District Engineer. The finished embankment dimensions shall be as shown on the drawings. Under Item 17, acceptable topsoil shall be placed to the required depth over the required areas. Under Item 18, the prepared topsoil surface shall be sodded, or shall be sown with first quality grass seed of an approved mixture, when and as directed by the District Engineer.

b. Placing topsoil. - Upon completion of the work required under Items 7, 8 and 11, when the earth dike shall have the proper height and dimensions as required by the District Engineer, the Area Engineer shall apply the stored topsoil (see Paragraph 3-02 a. (2)), or additional acceptable topsoil if required, to the required depth when compacted, over the slopes of the embankment to the limits shown on the drawings. The topsoil shall be lightly rolled or tamped and any unevenness of surface shall be corrected to conform to finished grades.

c. Sodding. - (1) The entire surface of the slopes of the earth dike shall be planted with living sods of Bermuda or some other acceptable grass which will best meet the climatic conditions as directed by the District Engineer. Sods obtained by stripping operations (see Paragraph 3-02 a. (2)) may be used if approved by the District Engineer. Each sod shall have an area of not less than 16 square inches. Sods shall be placed not more than 18 inches center to center for the minimum-sized sods; large sods may be spaced proportionately, depending on their size. The District Engineer may require certain areas to be completely sodded in strips. Sods shall be covered with one to two inches of earth as directed by the District Engineer, in such manner as to protect the roots from drying out. Sods shall be placed as soon as practicable after cutting, and newly placed sods shall be kept moistened by sprinkling when and as required by the District Engineer for a period not exceeding two weeks after placement on the dike.

(2) Sodding shall be commenced immediately upon completion of a length of 1000 feet of dike to final grade and cross section and shall be prosecuted at a rate satisfactory to the District Engineer.

(3) Seeding may be allowed by the District Engineer in lieu of sodding if in his opinion the seed resulting from seeding operations would provide better protection for the newly constructed earth slopes. The District Engineer may also direct that seeding shall be done to supplement the sodding operations.

d. Seeding. - (1) Preparation. - All grass or cover crop

seed shall be sown at the earliest practicable date in the spring, or when directed by the District Engineer, so as to secure the greatest possible protection against erosion. The finished surface grade of the slopes shall be maintained in a true and even condition during the seed-sowing operation, and the Area Engineer shall rake the soil to a depth of three-quarters of an inch ($3/4$ "") by using iron rakes immediately previous to sowing seed. All raking shall be done in a direction parallel to the contour lines on the slope and not uphill or downhill. All sticks, stones, woods or trash appearing on the surface shall be removed.

(2) Seed mixture. - The following mixture will be approved for each acre of seeding.

Perennial Rye Grass	7 lbs.
Orchard Grass	15 lbs.
Hard Fescue	4 lbs.
Kentucky Blue	6 lbs.
Sheep Fescue	6 lbs.
Timothy	7 lbs.
Perennial Red Clover	4 lbs.
White Clover	4 lbs.
Red Top	7 lbs.

Total per acre 60 lbs.

For all seeded areas, about 15 pounds of oats per acre shall be added if the planting is done between the middle of June and the middle of September, and about 15 pounds of winter rye per acre shall be added if the planting is permitted and done in the late season after the middle of September. Seed already on hand shall be used as directed by the District Engineer.

(3) Method of seeding. - The Area Engineer shall take advantage of favorable weather and shall employ a method of sowing satisfactory to the District Engineer. The seed shall be raked in and the whole surface then lightly rolled the same day, unless otherwise directed by the District Engineer. Seeding shall be done immediately after the preparation of the earth surface unless otherwise directed. If there be any delay, and if weeds grow in and with the grass, such weeds shall be cut before they go to seed or at such time as directed by the District Engineer. If any loam is washed away or any portions of the seeded areas are not covered by grass, the Area Engineer shall replace the topsoil, fertilize and re-seed.

(4) Maintenance. - The Area Engineer shall maintain the areas sown to grass seed on each section of the project, until all work on that section has been completed and accepted by the District Engineer. This maintenance shall consist of occasional mowing with a scythe or mechanical mower, watering during periods of drought, and

removal of large and conspicuous weeds, or any other similar operations whenever required by the District Engineer. The turf areas shall be fertilized with an acceptable commercial lawn fertilizer of a quality equal to Vigoro or Scott's lawn fertilizer at the customary quantity per acre recommended by the manufacturer.

e. Measurement and credit. - (1) The quantity of topsoil to be credited under Item 17 will be the number of cubic yards actually placed in accordance with directions, measured after compacting. Credit shall include the costs of all labor, materials and expenses incidental to furnishing and placing the topsoil. Credit will be made by the cubic yard under Item 17, "Topsoil on Embankment."

(2) The quantity to be credited under Item 18 will be the number of acres sodded and seeded as directed. Credit shall include all costs for sodding and seeding as specified in sub-paragraph c and d above, and for all materials and expenses incidental thereto. Credit will be made by the acre under Item 18, "Sodding and Seeding."

8-02. Gravel for top of dike (Item 19). - a. Work included. - The Area Engineer shall furnish and place gravel of the sizes and quality specified or directed for the surfacing of the top of the dike, and elsewhere on roadways and as shown on the drawings or as directed by the District Engineer.

b. Material. - The gravel shall be composed of hard, durable stones, together with sand and clay or other approved binding material, and shall be free from thin or elongated pieces. It shall be of such sizes that all will pass through a $3/4$ " screen with square openings, and not less than 35 per cent will be retained on a $1/4$ " screen with square openings. The gravel shall be uniformly graded. The finer material shall consist of sand and clay or other binding material approved by the District Engineer. Should the material as received for the work fail to maintain suitable proportions of coarse and fine particles, or should the coarse particles not be uniformly graded between the maximum and minimum sizes as specified, it shall be screened or manipulated in such a manner as to furnish a material to meet the above requirements.

c. Placing. - (1) The gravel surfacing shall be placed in one layer, and shall be 6 inches thick after compaction. After the subgrade or foundation shall have been prepared and compacted properly and proper drainage provided, the gravel shall be spread evenly by means of approved spreader vehicles or trucks. The gravel as spread shall be well-graded with no pockets of fine material or segregation of large and fine particles. After being spread evenly, the gravel shall be graded and compacted to the required thickness, by successive trips of the hauling and grading equipment, until a firm even surface is obtained. If at any time the gravel does not contain a sufficient amount of moisture to insure proper binding of the material, water

shall be added by means of a sprinkling wagon or any approved method in a sufficient amount to obtain the desired results.

(2) Compacting of the gravel shall start longitudinally at the side and gradually proceed toward the center of the roadway so far as practicable, overlapping on successive trips. During the process of compacting the gravel shall be dragged; the dragging and compacting shall continue until the gravel does not creep or wave under traffic.

d. Shoulders. - Shoulders shall be constructed as shown on the drawings and carefully maintained. Before the final completion of the work the shoulders shall be reformed, trimmed, and dressed as required by the District Engineer.

e. Measurement and credit. - Measurement will be made by the cubic yard for the amount of gravel surfacing furnished and placed in the completed work to the lines and grades shown on the drawings or as directed by the District Engineer. Quantities will be measured in place after compacting. Credit for all work in connection with gravel for top of dike, including furnishing, placing, and compacting the gravel will be made by the cubic yard under Item 19, "Gravel for Top of Dike."

8-03. Cleaning up (Item 20). - a. Work included. - The Area Engineer shall remove all construction equipment and all temporary structures built or used by him, shall remove rubbish of all kinds from the site of the work, and from any grounds which he shall have occupied within the limits of the work, and shall leave the site of the work in a clean condition satisfactory to the District Engineer. All materials salvaged shall be the property of the Government unless otherwise designated by the District Engineer.

b. Credit. - For all work, materials and incidentals required to clean up as set forth in a. above, credit will be made for the lump sum stipulated under Item 20, "Cleaning Up."